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SOVIET DEVELOPMENTS IN INFORMATION PROCESSING AND MACHINE TRANSLATION

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SOVIET DEVELOPMENTS IN INFORMATION PROCESSING AND MACHINE TRANSLATION

FOREWORD

This translation series presents information from Soviet literature on developments in the following fields in information processing and machine translation: organization, storage and retrieval of information; coding; programming; character and pattern recognition; logical design of information and translation machines; linguistic analysis with machine translation application; mathematical and applied linguistics; machine translation studies. The series is published as an aid to U. S. Government research.

Previously issued JPRS reports on this subject include:

JPRS: 68, 241, 319, 355, 379, 387, 487, 621, 646, 662, 705, 729, 863, 893, 925, 991, 992, 1006, 1029, 1130, 1131, 1132, 1133, 3225, 3300 and 3356.

SOVIET DEVELOPMENTS IN INFORMATION PROCESSING
AND
MACHINE TRANSLATION

[Following is a translation of selected articles from the Russian-language periodical Sovetskaya bibliografiya (Soviet Bibliography), Moscow, No. 5 (57), 1959. Inclusive pages and authors are given under the individual article headings.]

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I. THE ALL-UNION INSTITUTE OF SCIENTIFIC AND TECHNICAL INFORMATION AND ITS IMMEDIATE TASKS

The June plenum of the Central Committee of the Communist Party of the Soviet Union outlined a comprehensive program of technical progress in all branches of the national economy and enumerated concrete ways by which the material foundation of the Communist society may be swiftly laid. The great goal for which many generations have struggled is now being achieved in our country.

Fulfillment of the economic plans and development of industry and agriculture will largely depend on progress in scientific research. The role of science and the rate at which it is proceeding are steadily increasing. There are now some 3,000 scientific institutions in the Soviet Union and 280,000 scientific workers, whereas there were only 10,000 scientific workers in pre-revolutionary Russia. We must also bear in mind that scientific research is now being conducted not only by scientists in scientific research institutes and universities, but also by engineers in factory laboratories, workers and innovators at shop benches, and by agronomists and skilled collective farmers on the broad fields of the U.S.S.R.

Under these conditions comprehensive scientific and technical information is exceptionally important. The most efficient exploitation of the knowledge accumulated by man is one of the major problems of modern science. We have now reached the point where, in the words of the noted English scientist Professor Bernal, "it is actually easier to discover a new fact or construct a new theory than to try to find out whether they already exist". (Bernal, D., Nauka vistorii obshchestva [Science in the History of Society], Moscow, 1956, p. 681). This is not surprising in view of the tens of thousands of scientific and technical journals now published in many languages throughout the world, not to mention the large number of technical reports on the results of research. Some 200,000 patents for different inventions are registered every year.

One American specialist figured out that a chemist in command of 30 languages and reading at the rate of four articles an hour for 40 hours a week could cover in a year no more than one tenth of all the material published. That is why information publications have become so popular. Scientific information has become a vital factor in promoting science and technology. Foreign experts believe that the creation of an information center equipped with high-speed automatic machines would increase the output of scientists and engineers 10 to 25%.

Owing to the increasing need of Soviet science and technology for data on Soviet and foreign research, it was decided in 1952 to set up the

Institute of Scientific Information, which later became the All-Union Institute of Scientific and Technical Information (VINITI -- Vsesoyuznyy institut nauchnoy i tekhnicheskoy informatsii) of the State Scientific and Technical Committee of the Council of Ministers USSR and the Academy of Sciences USSR. The main publication of the Institute is a journal of abstracts, which differs from other information journals in that an effort is made to achieve the maximum inclusion of items in all fields of science and technology. Accordingly, it is becoming the most valuable publication of its kind, as well as a source of various types of selective information.

The abstract periodicals of VINITI now embrace the natural, exact, and engineering sciences, broken down into 13 series: "Astronomy and Geodesy", "Biology", "Biochemistry", "Geography", "Geology", "Geophysics", "Mathematics", "Machine Building", "Metallurgy", "Mechanics", "Physics", "Chemistry", and "Electrical Engineering". Each series has several major subdivisions.

In 1958 the 13 series contained more than 17,838 author sheets/see note/or about the same number as in the 140 volumes of the Great Soviet Encyclopedia. A total of 559,700 abstracts, including 44,000 patents, were published that year. As of 1 January 1959, all the abstract periodicals listed 1,164,000 items, including some 80,000 patents. Most of the periodicals are monthlies, but "Chemistry", "Biology", "Machine Building", and "Electrical Engineering" are bimonthlies each of which contains from 30 to 100 author sheets. The periodicals include more than abstracts. Some articles of lesser value are annotated or merely listed. "Machine Building", for example, carries bibliographic data on some 8,000 articles and books a month. /Note: Containing 40,000 typographic characters each./

To make the abstract journals handier to use, individual fascicles embracing one or more related categories have been issued since 1958 in addition to the comprehensive volumes in the different fields. For example, "Machine Building" comes out in five parts: "General Problems in Machine Building and Machine Design"; "Technology of Machine Building, Metrology, Means of Measurement and Control"; "Technology and Foundry Machinery"; "Transport, Traction, and Hoisting Equipment and Motors"; "Specialized Machine Building". "Metallurgy" comes out in two parts: "Production of Cast Iron and Steel" and "Welding", in addition to the comprehensive volume.

In view of the progress made in 1959, the Institute intends to issue in 1960 individual fascicles not for six but for nine series (a total of 57 fascicles). For example, "Machine Building" will be published in 16 separate fascicles.

The value of the abstract journals largely depends on the number of sources abstracted. Materials are handled in 50 languages from 92 countries. The Institute receives a cross section of the entire output of Soviet literature, as well as 12,250 foreign periodicals. VINITI has a publications exchange arrangement with 1,085 organizations in 60 countries: all the people's democracies, England, United States, Canada, France,

Italy, Greece, India, Japan, etc. In 1958 the Institute processed more than 100,000 journals, "transactions", and "proceedings", in addition to tens of thousands of Soviet and foreign descriptions of patents and specifications.

The Institute issues annual indexes to the abstract journals: author, systematic, subject, patent, and formula. The formula index of "Chemistry", for example, is compiled on the alphabetic principle from empirical formulae of chemical compounds. Beside each formula is its interpretation in accordance with the nomenclature adopted in this index plus the numbers of the items in the journal that contain this formula. The indexes greatly facilitate use of the abstract journals and make it possible to locate quickly whatever may be needed from the annual mass of material. It is obvious, however, that not all the readers or even librarians are aware of the value of the indexes, for the number of subscribers to them are far fewer than to the journals themselves. In addition to the annual indexes, the Institute is planning to publish 10-year indexes the importance of which for retrospective bibliography could scarcely be overestimated.

The Institute also prepares various kinds of selective information, e.g., "Express Information," which deals with the most important problems in science and technology appearing in foreign materials. It consists of detailed abstracts or abridged translations of articles accompanied by illustrations, diagrams, and sketches. This publication often makes it unnecessary to go back to the original. "Express Information" is designed for widespread use among engineers and technicians, skilled workers, teachers, graduate students, and undergraduates. "Express Information" comes out in 49 series, including "Automatic Control of Industrial Processes," "Airplane Motor Building," "Atomic Energy," "Food Industry," "Synthetic High Polymers," etc. Each series is published in 48 numbers a year.

We have begun to publish a series of monographs entitled Itogi nauki /Achievements of Science/ based on the abstract journals. The purpose is to summarize developments in the various branches of science for a given period of time. Some numbers already issued are "Problems in the Theory of Nonlinear Systems of Automatic Regulation and Control," "The Biological Effect of Ionizing Radiation," etc. We have also compiled subject "Surveys of Modern Technology" in which foreign and Soviet experience in major fields is summarized, e.g., "The Chemical Effect of Ionizing Radiation," "Progress and Trends in Automobile Motors," "Program Control of Metal-Cutting Tools," "One-Bucket Excavators in the USSR and Abroad," "The Development of Chemistry and the Chemical Industry in Japan," etc.

The Institute also prepares bibliographic manuals on particular problems, e.g., the annotated "Iron Ores" (edited by academician I. P. Bardin), a joint effort of VINITI and the A. A. Baykov Institute of Metallurgy. It cites more than 13,000 Soviet and foreign books and articles and has author, geographic, and subject indexes.

Strengthening of the territorial principle of administering the national economy has stimulated the demand by scientists, economists,

engineers, and production innovators for literature on the natural resources, conditions, population, and economy of the individual regions. That is why the Institute has compiled several bibliographic indexes on the economic regions of the USSR. The indexes cite approximately 15,000 works. A major survey of the technical and economic literature on "Industry, Transport, Scientific and Cultural Institutions of Great Britain" is ready for the press. Similar surveys are being planned for several people's democracies and capitalist countries.

VINITI is providing substantial help to enterprises and individual readers by fulfilling their requests for microfilms and photostats of books and articles abstracted in the abstract journals and "Express Information." Moreover, the Institute staff has a translation section that meets the requests of businesses, scientific institutions, and organizations for translations of scientific and technical literature in all languages. There were some 5,000 pages of author sheets in the total volume of translations made by the section in 1959. Annotations of these translations are placed in special catalogs.

The information materials are prepared by a large group of highly qualified specialists, including a number of academicians and corresponding members of the Academy of Sciences USSR, dozens of doctors of science, and more than 200 candidates of science. The Institute relies on an extensive network of part-time abstractors and translators. Some 20,000 are now engaged in this work, several hundreds of them in the people's democracies. Work with the many thousands of authors is also a form of operational information. In 1958, for example, we sent about 500,000 photostats of articles to the abstractors. Part-time abstractors working in factories and research organizations systematically abstract items in their fields and at the same time find it possible to use the most valuable of them in their own practical work. This is an incentive for the abstractors to cooperate with VINITI. Entire branches of the various sciences are abstracted by teams of experts from different institutions (e.g., several departments in the Moscow Aviation Institute, engineers in the "Red Proletarian" Factory). We intend eventually to draw into this abstracting activity scientists from a number of universities, research institutes, and industrial workers.

The Institute's publications have major national economic significance. Many enterprises are introducing new techniques which they read about in the abstract journals and "Express Information," as shown by the numerous letters and statements we have received. For example, the Rostsel'mash Plant had been unsuccessfully trying for a long time to obtain cast iron of great durability and at the same time capable of heat processing. The problem was solved only after the workers used an abstract from "Metallurgy." A reference in "Chemistry" enabled the same plant to introduce swift drying reinforcers into production within 2 weeks.

The head of the central factory laboratory of the Dneprospetsstal' Electrometallurgical Plant wrote a letter to say that the abstract journal "Metallurgy" is the most valuable aid for his metallurgists and is in

great demand. They particularly appreciate the combining in one volume of information on the metallurgical industry with literature on the allied fields.

The chief engineer of the Kirov Factory in Leningrad notes: "The usefulness of the materials in "Express Information" lies in the fact that they indicate the direction in which metallurgical technology is developing abroad, permitting us both to compare the level of foreign achievement with our own and to avail ourselves of new and advanced methods employed in concrete situations. This mass of information is helping us to introduce technological improvements in our assembly and forging shops."

Materials in the abstract journals and in "Express Information" are used by specialized information services for their own publications. For example, the Central Bureau of Technical Information of the Scientific Research Institute of the Electrical Industry issued the collection "Annotations of Foreign Patents," based on abstracts from "Electrical Engineering."

The work of the All-Union Institute of Scientific and Technical Information has great international value. The fact that 25 to 30% of the copies of the abstract journals go abroad is revealing.

The Institute's publications enable the researchers and experts of the people's democracies to familiarize themselves with the state of Soviet and world science and technology. For example, several of the abstract journals are translated cover to cover in the Chinese People's Republic ("Machine Building," "Metallurgy," etc.). These publications are at the same time a means of propagandizing the progress of Soviet science and technology abroad. The New York Times of 24 November 1957 quoted a member of the National Science Foundation in Washington as saying that the best way for Americans to improve information in a given field is to copy the abstracts published by the Soviet information institute and to translate them into English. The Soviet experience is exerting a steadily increasing influence on the organization of scientific information in the U. S. Although there is no centralized state information service, various steps are being taken to coordinate information activities. For example, a Federation of Information Services was created this year, including "Chemical Abstracts," "Biological Abstracts," "Nuclear Science Abstracts," and various abstract and bibliography journals on engineering, medicine, agriculture, and military matters. Together they produce annually about 400,000 abstracts which, American sources note, are approximately equal to the VINITI output. A visitor to our Institute, the prominent American expert on information Professor Kent, suggested that the U.S. arrange to translate in full all the "Express Information"series.

VINITI is a graphic demonstration of the superiority of the Soviet way of promoting science, which cannot be followed by the capitalist states. Thus an American congressman, Charles Vanik, declared:"Our lag in science is due to many complex causes, but we must admit that the major responsibility rests on our obsolete and ineffective system of disseminating and using scientific information."

Making a general appraisal of VINITI, the American journal Biological Abstracts (1957, No. 12) stated that "the Institute records works and ideas more fully than any other organization in the world past and present." And there are many other such testimonials to the Institute that we could cite. VINITI maintains extensive international contacts, is a member of the International Federation for Documentation, and participates in the work of the abstracting office of the International Council of Scientific Unions.

Despite its great achievements, the Institute is far from satisfying the demands made on it. There are still no abstract journals on medicine, agriculture, construction, and transport. Specialized information services cannot keep up with the voluminous materials in their fields. The abstract journals still do not fully reflect world scientific and technical literature in these branches of knowledge. This is particularly true of books, "transactions," and reports of scientific institutions. The interval between obtaining the materials and publishing the abstracts is still too long, averaging 6 to 8 months or more for the journals, about 4 months for "Express Information." The journals used to come out very late, thereby making them largely useless, but this shortcoming was corrected during the past year for most of the series and the journals now generally come out on time. There were years when no indexes to the journals were issued. The Institute has taken measures to issue and send to its subscribers this year and the first 6 months of next year indexes for the last period, so that starting with 1960 they will receive the regular indexes no more than 4 or 5 months after the latest number of the journal for the past year.

VINITI will expand and improve its preparation and publication of informational publications during the next 7 years. New abstract journals will be forthcoming: in 1960, "Mining" and a bimonthly, "Industrial Economics"; in 1961, "Transport" (embracing all types) and "Public Health." The number of series of "Express Information" will amount to 57 by the end of the Seven-Year Plan and include 5,900 author sheets.

The interval between receipt of journals and books and publication of abstracts will be substantially shortened. This will be done both by improving the technical methods of preparation and issuance of manuscripts and by employing new, advanced equipment.

New types of information will be organized. Beginning in 1960 VINITI will issue jointly with the All-Union State Library of Foreign Literature annotated cards for articles published in the foreign periodical press on mathematics, mechanics, physics, chemistry, and biology. For the readers' convenience subscriptions will be accepted for series embracing the major divisions of the sciences just mentioned.

VINITI intends to compile and publish in the near future a five- or six-volume annotated index of the world's scientific and technical periodicals. The index issued in 1939 is completely out of date. It contains only 2,200 titles against the 15,000 for the new reference work. The description will include: name of journal, place of publication, year it was founded, periodicity, average numbers of pages, subscription price.

The annotations will provide information on subject matter of the journal, nature of the items included, etc. This bibliographic guide will be a valuable tool for libraries to fill out their collections with Soviet and foreign periodical literature, compilation of bibliographic lists and indexes, and recommendation of journals to readers. Scientists and engineers will be able quickly to select all the journals in their specialties or on some particular subject.

It is our task to enlarge the present information and reference program to satisfy the needs of scientific institutions, commercial enterprises, and other organizations.

Most of the problems facing VINITI will be solved only by the extensive mechanization and automatization of the processes involved in the preparation and publication of manuscripts. Two laboratories have been set up in the Institute to investigate this immense and complicated task. The Laboratory of Mechanization of Information has now produced a machine to compile author indexes. It works as follows. While a bibliographic card is being printed on a typewriter, an electronic device attached to the machine punches a card. The punched cards accumulated during the course of a year are quickly sorted alphabetically by a mechanical sorter of the type widely used in accounting. The cards are then inserted into a small electronic apparatus connected to a specially equipped typewriter, which automatically and at high speed prints lists of authors in alphabetic order. This experimental unit has already been used to prepare hand copies of author indexes. It will later be adapted to prepare subject indexes.

The model of an electronic attachment to set a text automatically on a standard linotype has been produced and tested. At the same time that a manuscript is printed on a typewriter, a narrow tape is punched and then passed through an electronic device that automatically sets the text on the linotype. The machine can only handle simple settings, but efforts are being made to adapt it for complicated texts, i.e., by using additional linotype castings.

We also have an experimental model of an information-reference machine. A few minutes after a request is coded, the machine selects the pertinent bibliographic cards at the rate of 400 a minute. The cards may include not only a bibliographic description of the source, but also an annotation or even an abstract. The Laboratory of Electromodeling is also working on high-speed information machines with large, stable, and lasting "memories." The Laboratory has almost finished the construction of a test machine to be adapted for informational work in chemistry.

Besides creating its own machines, the Institute intends to use several foreign designs. For example, instead of microfilm, we propose to make microreproductions of original publications (books and articles) on microcards. A microcard is a photographic film 9 x 12 cm in size on which 32 to 105 lines of text can be fitted. Apparatuses to read microcards are very compact. Much less space is needed to store microcards than to store microfilms. We also plan to acquire a machine for rapid duplication of photoprints of articles and books not based on the "wet"

photoprocess. Punched cards with manual sorting will be extensively used, besides complex machines, to mechanize the technological processes employed in the preparation of the abstract journals.

The staff of the All-Union Institute of Scientific and Technical Information is using all its strength and knowledge in behalf of scientific and technical progress and the successful fulfillment of the Seven-Year Plan to promote the national economy of our country.

II. BIBLIOGRAPHIC INFORMATION WORK — AN IMPORTANT STAGE IN SCIENTIFIC RESEARCH

The Communist Party and Soviet Government devote considerable attention to scientific and technical information as essential means of ensuring progress in all branches of the national economy. The July 1955 Plenum of the Central Committee of the Communist Party of the Soviet Union and the XX and XXI Congresses of the CPSU exerted a decisive influence in substantially raising the quality of scientific and technical information.

The tasks assigned by the XXI Congress of the CPSU to promote all branches of the national economy and to increase the productivity of labor through the mechanization and automatization of industrial processes urgently demand radical improvement of scientific and technical information and popularization of the latest achievements in science and technology. Soundly organized information and publicity are extremely important for the state.

Many organizations in the USSR engage in the processing of scientific and technical information: the information services of the national economic councils; the state scientific and technical committees attached to the councils of ministers of the union republics; scientific research institutes; planning and design organizations; commercial enterprises; central bureaus of technical information; scientific and technical libraries; publishing houses; houses of scientific and technical publicity; scientific and technical societies; the All-Union Society for the Dissemination of Political and Scientific Knowledge; etc.

Journals play a major part in scientific and technical information. A great many new information services have come into existence during the last 10 years. Departments and offices of technical information have been organized in many enterprises, scientific research institutes, and design organizations. In 1952 the powerful information and bibliography center, the All-Union Institute of Scientific and Technical Information (VINITI) of the State Scientific and Technical Committee, Council of Ministers USSR and Academy of Sciences USSR, was organized. In 1958 the Council of Ministers USSR decided to set up state public scientific and technical libraries in Moscow and Novosibirsk.

The organization of information in our country has a number of serious weaknesses (duplication in issuing informational materials; lack of control over the use of these materials; irregular issuance by VINITI of abstract journals and indexes; insufficient treatment of important problems of engineering and economics, of the experience industrial innovators, in scientific-technical and industrial-technical journals; no coordination of translations of articles in the foreign periodical press, etc.).

A special decree of the Council of Ministers USSR assigned responsibility for guiding and coordinating the work of all organizations

engaged in handling scientific and technical information to the State Scientific and Technical Committee of the Council of Ministers USSR; in the field of construction to the State Committee of the Council of Ministers for Construction; and in the union republics to the republican scientific and technical committees and (control) committees for construction. Responsibility for the practical guidance of information services has been entrusted, in addition to the above-mentioned organizations, to the state committees of the Council of Ministers USSR for the various branches of industry, the ministries and departments of the USSR and union republics, and the national economic councils in accordance with departmental jurisdiction over the respective information services.

In August 1959 the State Scientific and Technical Committee of the Council of Ministers USSR created several new information institutes from the existing central bureaus of technical information — electrical engineering, instrument construction, machine building, light and food industry.

A certain order has been set for the issuance of informational literature. Information services may publish periodically and charge for collections of review articles reflecting the achievements of Soviet and foreign science, technology, and innovations in major branches of the national economy.

Systematic control has been placed over the use of scientific and technical information in enterprises and construction works in order to ensure the swiftest possible introduction of new ideas advanced by scientists, engineers, and industrial innovators. Efforts are being made to improve the translation program.

Several steps have been taken to eliminate the defects in the work of the VINITI, particularly to hasten the issuance of the abstract journals, increase the number of series, etc. The information services of scientific research institutes and enterprises has been improved and the level of their publicity activities substantially raised. New methods of collecting, systematizing, searching for and summarizing information have come into being. All this makes it possible to supply timely new information to government departments, shops, laboratories, and independent specialists connected with institutes and enterprises.

Ways and means of perfecting informational and bibliographic forms and methods are now being widely discussed not only in the USSR, but also abroad: the German Deomocratic Republic, Czechoslovakia, USA, England, Sweden, and elsewhere. Different problems are treated in specialized publications, technical journals and newspapers, and at conferences. In November 1958 a number of problems were analyzed at the International Conference on Scientific and Technical Information held in Washington. Representatives from many countries, including the USSR, took part.

The rapid growth of new scientific discoveries and research and the development of new fields of human knowledge and new branches of industry are giving rise to a vast flow of scientific and technical literature. The increased volume of information is complicating the process of searching for, processing, sorting, systematizing, and analyzing

materials. According to figures published in the press, the amount of scientific and technical information at the beginning of the second half of the twentieth century was almost 10 times that at the end of the nineteenth century. Since books were first printed, more than 50 million works have been published, including 5 million patents. Every year over 250,000 books are published throughout the world, of which some 50,000 are concerned with scientific, technical, and industrial questions. Fifty thousand scientific and technical journals containing about 4 million articles and 250,000 new patents are issued. Commercial prospectuses and catalogs are in excess of 500,000 annually. Not all the results of scientific research or industrial practice are made available in the public press. Often highly significant data are found in research reports and planning studies, scientific dissertations, patents, engineering surveys, translations, etc., which appear in limited editions and very late. More than 250,000 such works come out every year. As much as one or 2 years may elapse between the completion of a new study or experimental model and a reference in a journal; it may appear in a book 2 to 4 years later. Some 5 million new technical and scientific informational items are published every year throughout the world in the most diverse sources (books, journals, scientific reports, records of tests, government literature, patents, specifications, etc.) in all languages.

The result of all this is that scientists and engineers are unable to keep up with the output of technical materials even in their own narrow specialties. They have to spend a good deal of time searching for what they want and sometimes they fail to find it.

If only a quarter of the technical and scientific materials published annually in the world were collected and systematized, the information problem would be much less difficult than it is. Unfortunately, this is not the case. A specialist searching the literature may find only part of what he needs published in the primary journals on the subject. The rest of it is likely to be quite scattered. For example, someone interested in the electrical conductivity of the earth would have to look through journals of physics, chemistry, geology, agriculture, machine building, electrical engineering, telegraphy, telephony, radio communications, television, etc. It has been shown that out of 1,332 articles on geophysics 429 were printed in nine specialized journals (and thus easy to locate), while 903 were found in 317 little-known journals not directly related to geophysics. Informational materials on electrical engineering (some 25,000 a year) are published in 400 periodicals in many languages. Specialists lacking the necessary knowledge of bibliography and scientific information and, as is often the case, unfamiliar with foreign languages, cannot exploit the numerous sources of information available. They are unaware of the resources of a bibliographic information organization. At the present time even trained information specialists have difficulty in processing the huge mass of literature reaching them. The finest abstract journals with their large staffs are unable to include more than 20% of the technical articles and abstracts thereof from the vast number of periodicals in a given field of knowledge.

Scientists or engineers receiving several journals normally cannot keep up with over 1 or 2% of the pertinent materials published in the world. Experience has shown that information services can record and process approximately 50% of the incoming literature on a particular subject with fair speed. They have become independent organizations with a number of groups and subdivisions. Each group performs complex and varied functions. /Please see Figure Appendix./

The Scientific and Technical Information Group of an institute searches for and acquires materials; maintains liaison with bibliographic, research, planning and design organizations, and industrial establishments working on similar and related problems. It examines Soviet and foreign scientific and technical literature and informational materials. It annotates, abstracts, and selects information for subject folders. It obtains information on new patents and processes patent literature. It selects informational materials at the request of other organizations, answers queries of research departments and laboratories of the institute regarding the obtaining of technical information. The group systematically informs the departments and laboratories about the literature on various branches of technology as a whole and on individual topics with which they may be concerned. It arranges for an exchange of experience between departments and laboratories. It obtains reports on new parts and assemblies, instruments, and apparatus. It exchanges technical information with other organizations and commercial enterprises. The group maintains a card file of parts, assemblies, blocks, and diagrams worked out by the institute. It maintains files of annotated cards on completed research and experimental design projects of this and other institutes and enterprises working on similar or related problems.

Engineers in the Scientific and Technical Information Group participate in the preparation and supervision of "information day,"arrange trips to departments and laboratories of the institute and to other organizations concerned with the literature issued by the institute, and obtain literature from other organizations and enterprises. The group provides guidance on methods to the technical informants of the departments and laboratories. Technical informants are directly attached to this group and to the Scientific and Technical Library. The tasks of the technical informants are to discover the needs of laboratories and individual specialists for scientific and technical information, lectures, reports, consultations; to arrange for the showing of films; to visit other institutes, factories, and bibliographic organizations to study scientific, technological, and industrial achievements. Technical informants report systematically to the Scientific and Technical Information Group on new studies that have been completed or are in progress. One of their main responsibilities is to familiarize themselves with literature and informational materials coming into the department and library and to inform the personnel accordingly. Technical informants maintain a systematic card file on the subjects of interest to the laboratories and keep it up to date. They report to the head of the department or laboratory on information selected and check on the way it is used in the work of the laboratory.

The Scientific Analysis and Survey Group arranges for surveys of the main current and long-range programs of the Institute. It guides the authors of the surveys on methods. It analyzes and summarizes the informational materials collected and sorted in the section. It coordinates the work on surveys in its own fields (if the institute is a central one). The group prepares individual topical publications of operational information.

The Scientific and Technical Bibliography Group organizes, systematizes, and maintains the central card files. It provides bibliographic reference services to the departments, laboratories, and individual specialists. It compiles retrospective subject indexes of the literature on an annual basis and on special request. It annotates and lists articles from Soviet journals. It prepares annotated card files for publication.

The Editorial and Publications Group plans the annual and quarterly publication schedules of the section. It chooses authors, scientific and technical editors and copy readers, and works with them. It edits publications from the literary point of view and gets them ready for the press. It prepares appropriate illustrative material.

The Organizational-Methodological and Scientific-Technical Publicity Group provides guidance on methods to information services on branches of technology as a whole. It organizes technical centers and exhibits. It arranges and conducts scientific and technical conferences and meetings to exchange experience. It arranges for lectures and trips to commercial establishments. It examines the programs of information services and prepares comprehensive publication plans.

The Senior Engineer-Economist prepares annual, quarterly, and monthly programs for the information service and its groups. He checks on the implementation of the programs and records the inflow and movement of manuscripts.

The Scientific and Technical Library handles books, periodicals, and government literature. It serves readers on a subscription basis and in the reading room, and procures items on inter-library loan. It organizes and develops library catalogs and card files. It lists government publications and new acquisitions. It organizes and supervises "information day," exhibits of new books and periodicals, and stocks the library with books.

The translation Group keeps track of translations of informational materials in other organizations, maintains a card index of translations prepared by other organizations, and makes written and oral translations.

The way the processing of books, periodical articles, and government and other literature is organized can be traced in the example of a research institute information service outlined in the present Figure Appendix.

All incoming books, Soviet and foreign journals, newspapers, patents, publications of research institutes, factories, experimental design offices, bibliographic and informational materials, etc. are

marked by the director of the information service or scientific and technical information group of this service. They examine the materials and mark it in a special way: one check indicates that the item is to be entered in the central systematic bibliographic card file; two checks indicate that, in addition, it is to be called to the attention of departments and laboratories and entered in their systematic bibliographic card files; a red check means that it is to be annotated or abstracted, with copies transmitted to the Editorial and Publications Group for inclusion in the publications of the information service; the letter "D" means that two photocopies are to be made for the subject folders. (This is done mainly for materials lent to the information service for a short time so that the service can familiarize itself with the contents.)

After being marked, the governmental materials and books are sent to the library for processing. The librarians make cards which they send on to the Editorial and Publications Group and to the Scientific and Technical Bibliography Group. The latter uses them to compile a "Bulletin of New Acquisitions" and then incorporates them in the central systematic card file.

Soviet journals and "Express Information" are sent for processing to the Scientific and Technical Bibliography Group, which makes out cards for the articles listed there and sends them to the central file.

Foreign journals are handled by engineers of the Scientific and Technical Information Group. They prepare bibliography cards for the articles from these journals (each engineer is assigned certain journals) and abstracts, and they arrange for photocopies. These cards come to the Scientific and Technical Bibliography Group, which files them in the central file. Processed Soviet and foreign journals and other materials are sent to the library for "information day". /See Note/ In connection with this day the bibliographers classify the cards for articles from journals and other items acquired during the preceding 15 days, preparing from them a subject card index which is shown along with a suitable batch of literature on "information day". /Note: On "information day," cf. G. I. Gol'dgamer "Bibliographic Information Work in a Research Organization," Sovetskaya Bibliografiya (Soviet Bibliography), No. 52, 1958, pp. 65-73./

After "information day" all the cards for the items marked with two checks are numbered and sent to the Editorial and Publications Group for the annotated card index by means of a radioelectronic device. It is printed on a rotary press. The printed sheets are cut up into individual cards, sorted, and sent on to the Scientific and Technical Information Group. The engineers of this group, who are responsible for supplying information to the departments and laboratories of the institute, etc., review the cards and turn them over to the technical informants of the departments. Sets of cards with annotations are circulated twice a month to other organizations for mutual information.

The efficient organization of technical information is becoming a major problem for research institutes, planning and design organizations and commercial establishments. A soundly conceived system ensures a substantial saving of time for research and the introduction of new techno-

logical developments into production; improves the quality of their work; and enables the authorities to gain familiarity with the latest achievements in the USSR and abroad. The following excerpt from a statement by the scientific and technical council of a research institute is pertinent: "Scientific and technical information is exceptionally important for a research institute. A well organized information service is inseparable from the research process and experimental design studies, since it ensures the exploitation of the latest achievements in the relevant fields of science and technology and helps to solve the problems facing the institute in the shortest possible time with the minimum expenditure of energy and money. An information service should be an integral part of every investigation or study. It plays a major role at the initial and final stages by preparing bibliographies, selecting literature and other sources, making summaries (publication of reports, informational items, articles, etc). Moreover, an information service can help to raise the general scientific and technical level of the institute's work and arrange for exchanges of experience between the various subdivisions and between individual experts. An information service is useful in clarifying for the personnel of the institute the general problems, fundamental principles, and ideas underlying the devices and systems being developed."

This statement particularly stresses the need of preparing a bibliography at the start of any new research project or planning study. (It may be either a subject index of the literature or a survey of the relevant trend of the field of interest.) Consequently, the bibliographic work of the information service of an institute, factory, or design or planning organization is always timely.

The work schedule of the information service of a research institute must largely match that of the new projects or planning studies, while the schedule of the information service of an industrial enterprise must be coordinated with the plan for introducing new techniques and administrative measures. This applies primarily to such parts of the information service's program as preparation of surveys of subject indexes of the literature, translations, reports, lectures, consultations, technical film showings, temporary exhibits, visits to other enterprises, etc.

The program of an information service may be long-range as well as current. In long-range planning due regard is taken for the need of selecting and annotating not only literature required today but also those materials that may be useful 1, 2, or more years later. They are entered in the central systematic card file, "Bulletin of New Acquisitions by the Scientific and Technical Library," subject folders, etc.

A current program provides for the preparation of surveys, subject indexes of the literature, translations, and analysis of the experience of organizations working in the same or related fields; and the classification of patents, dissertations, reports compiled at the end of a research project, and other materials relevant to the current work schedules of research institutes and enterprises.

A feature of the programs of information services is that they

note the need not only of collecting, systematizing, and summarizing the literature, but also of creating new materials. For example, it is necessary to give wide publicity in various technical publications to reports on new projects being carried out in research institutes and design offices and on technical advances in industry. The task of an information service is substantially lightened if the research institute or factory has a long-range developmental plan for 3 to 5 years or longer. Unfortunately, a number of institutes and plants do not have such plans, thereby making it difficult for engineer-informants and bibliographers to select and arrange materials in accordance with the direction followed by the work of these institutes and plants. If these plans exist, the information service is in a position to prepare and issue up-to-date studies of the relevant field describing the experience of Soviet and foreign science and technology. These might include subject indexes, surveys, abstracts, annotations, translations, etc. The service can also add to the catalogs; issue periodically collections of informational articles, scientific and technical documentation; arrange for lectures, reports, conferences and films.

It is essential that the plans of the information service of an institute or enterprise be widely discussed by the scientists, engineers, inventors, innovators, and efficiency experts. This results in the inclusion of more timely materials and makes implementation of the plans more practicable. Many information services submit their outlines for collections of technical materials, surveys, and subject indexes to the departments, shops, and laboratories, which discuss and return them with comments and suggestions. Outlines of collections contain the subjects of the articles, length, and suggested authors. Outlines of technology surveys list the subjects, authors, departments and laboratories responsible for making the surveys, and the deadlines. Outlines of subject indexes mention the topics, period of time to be covered, types of literature (books, journals, etc.), languages to be included, name of the consumer, and scientific-technical editor.

After the outlines for scientific and technical collections, surveys, and indexes are approved by the heads of the research institute or enterprise, they are turned over to the planning section. Compilation of the collections, indexes, and part of the surveys on the main work trends of the institute are incorporated into the program of the information service and distributed by the director of the service to the individual units. Some of the surveys are added to the program of the appropriate research departments and laboratories (working on a group of problems as well as individual projects).

The subject plans are coordinated with calendar plans and charts prepared by the laboratories and departments for each new research project or experimental design study. The calendar plan or so-called form No. 4 provides for each stage of research, including bibliography, design studies, drawing up of scientific and technical documentation, manufacture of models, samples, etc. Bibliography and informational activities outlined on form No. 4 consist in: preparation of subject indexes covering

the literature for a certain period of time (2, 3, 5, or more years); preparation of subject indexes of more or less current material; arranging for translations; organization of consultations, lectures, field trips, exhibits, and visits to other institutes to gain familiarity with the materials there. The calendar plan mentions the times of starting and finishing tasks to be performed by the information service independently and jointly with other departments in the institute.

If it is to be useful and effective, it is essential that the bibliographic work be coordinated with the individual phases of research projects and experimental design studies.

The various groups in the information service receive their work programs once each quarter. They make monthly reports. This enables the head of the service to keep effective control of the way the programs are being implemented.

Before a new project is started, the experts come to the information service with these questions: has the problem on which we are starting to work ever been solved, and, if so, when ? And if it has been solved, where and how? The bibliographer can answer the first two questions of interest to the institute, sorting, processing, and classifying them in accordance with a special scheme and informing the departments and laboratories accordingly. The other two questions are handled by the engineer-informant. He examines the available materials on the problem (Soviet and foreign, current and dated), selects, analyzes, and evaluates the information that might help to solve it.

The bibliographer examines and sorts a vast amount of literature. The engineer-informant of an information service or technical informant of a laboratory, shop, or department chooses and studies only that literature which is pertinent to his unit's task. The bibliographer serves a great many engineers and technicians, innovators, inventors, efficiency experts, and scientists, whereas the engineer-informant and technical informant serve individual researchers working on a single specialized problem.

The role of the bibliographer and engineer-informant in the scientific and technical information system has been treated in detail and, in our opinion, accurately in Vyuzivani technickych informaci (Prague, 1958) /The Use of Technical Information/ by the eminent Czech specialist in the organization and methods of bibliography, Inzhi Toman.

Data accumulated and sorted over the years are often the sole source available for determination of the plans for new projects; the introduction of new techniques; execution of administrative and technical measures; processing of requests for new equipment, apparatus, instruments, and materials. They are also useful in research and design projects being conducted simultaneously elsewhere.

The engineer-informant and bibliographer, if they are to satisfy the needs of the experts, must first study the bibliography card files and subject classifications in the organization. The information that they contain does not generally appear in printed bibliographies. Experience has shown that the information specialists find the most

valuable and up-to-date materials in the central card file; the files on apparatus and devices, assemblies, and parts; indexes of publications of foreign firms; files of illustrations; and files of projects in progress and completed. Thus the bibliographers, engineer-informants of the information service, and technical informants of the laboratories help their institute or enterprise to utilize better apparatus, machines, and instruments.

Let me give several examples of the way that engineer-informants and bibliographers participate directly in the work of a research institute at the crucial stage when the direction, scope, and scientific level of a new project are largely determined. The plan for compilation of subject indexes of the literature for 1959 provided for the information service of a research institute to find out in the third quarter what was published on the topic "The Connection between Various Systems of Coordinates." Accordingly, the bibliographer prepared an index of the literature containing a large number of items on the problem under investigation, and which many investigators had not suspected existed. Members of the laboratory said about this index: "The index prepared on the topic "Systems of Coordinates," embracing material published between 1953 and 1959, is of great value. It adequately meets our needs and is helping us to perform our assignment more quickly and efficiently; it is therefore deserving of high praise. We shall soon have a more complex and difficult task on the same subject." It is evident from this testimonial that after studying the literature mentioned by the bibliographer they drew from it far-reaching conclusions and decided to enlarge the project beyond what had been originally contemplated.

Another laboratory reports that materials obtained from its information service on "Diode Decoders of the Number Code Type" made it possible to use the principle of designing a decoder in a new way.

Thus a scientific project or planning study or the introduction of a new article in industry begins with a determination of the sources containing the desired information followed by the collection, systematization, and summarization of the material. We are convinced that the quality of the subject index compiled at the request of departments, laboratories, or shops and the classification of the most useful and up-to-date information are largely contingent on the proper organization of the work of the engineer-informant and bibliographer. To our way of thinking, the most efficient method is the following. In consultation with the leading expert of the laboratory who requests the information, the engineer-informant and bibliographer find out the primary sources of which coverage is desired along with the time limits, since there is often no need to check materials going back many years. A work plan is then drawn up listing the sources to be examined, the particular sections of the systematic card files to be searched, and the deadline.

A search is first made among the materials of the scientific and technical information section and of the library. Then all available bibliographies of recent literature on the subject are examined and visits made to institutions where the desired sources may be found.

The selected literature is classified and a preliminary list drawn up and submitted to the consumer who indicates to the bibliographer the items of interest to him. The sources needed for his work are then personally inspected, the most important foreign articles translated, extracts made, photographs of illustrations and materials taken of things not in the information section or library. The assembled material is again classified and the consumer revisited, after which a survey of the literature or subject index is compiled in which the bibliographic data are accompanied by annotations or brief abstracts. The final report is delivered to the laboratory and circulated among interested specialists and organizations.

All the procedures just enumerated are largely carried out by elements of the information service -- scientific and technical bibliography group, scientific and technical information group, survey group, and scientific and technical library. These groups are the first units to begin work on a new research project or planning study. Consequently they receive their assignments 2 or 3 months before the research personnel start. The successful solution of a problem requires the close cooperation of librarians, bibliographers, and engineer-informants. Their coordinated activity ensures a finer selection of literature and substantially reduces the amount of time spent at the preparatory stage of a research project. The librarian collects the materials; the bibliographer extracts and classifies the pertinent data; the engineer-informant studies them so as to be able to inform the investigators, designers, or manufacturers.

The usual result of this activity is a survey of the literature or a selective listing. The work of the bibliographer and engineer-informant in some institutes of the USSR and abroad is not delimited. In such information services the two work together in preparing the bibliography and studying the literature on some specific aspect of the subject.

A search of the literature, i.e., the search, selection, arrangement, analysis, and evaluation of printed and other materials, is subdivided into several types, depending on the complexity of the request. The simplest type of investigation is to answer the query of a specialist as to what book or article might contain the information he is interested in. Another type involves locating the publications containing the articles of some author on a particular topic. The most complex, time-consuming, and responsible task of an information service is to meet the request of a specialist for everything published throughout the world on a given subject. If personnel in the departments and laboratories systematically keep up with the literature, they ask for a selection of all the available material on a particular problem, one that is usually narrow and specialized. In this event most of the effort is directed to compiling the fullest possible list of pertinent, up-to-date books, articles, etc.

The results of a search of the literature, as noted by the well-known American authority on information Augustine Murtha, are varied. There may be a complete or selective list of titles. The specialist is

acquainted with the content of these books, articles, etc. Sometimes the result of a search and analysis of the literature is a report containing expanded annotations on the sources examined, but with no critical evaluation. This report is very helpful to the specialist, since it occasionally makes it unnecessary for him to study the books or articles themselves. Another useful result is a report containing a critical analysis of the materials on a particular subject.

A study of the literature sometimes ends in the preparation of a survey. The survey includes an analysis of how the problem is solved in the literature, a critical evaluation of the individual sources, and suggestions as to the direction in which subsequent research on the subject might proceed. This type of study is extremely valuable. The preparation of a survey requires specialized knowledge and considerable skill on the part of the engineer-informants. All surveys prepared in research institutes or commercial enterprises may be divided into the following types: surveys directly related to fulfillment of the plan of the institute or enterprise for the current year; surveys of specific problems arising in the course of the work; surveys of individual branches of technology executed systematically in accordance with the long-range plans of research and design organizations.

The sources are divided into books, journals, governmental literature, patents, reports on research and design studies: A "universal study" is the most important type of literature search. It includes a review of everything published anywhere at any time and a survey to be used for appraising the extent to which a given problem may have been worked out on a world-wide basis.

Written materials constitute primary sources when they contain information as such (books, journals, patents, governmental literature, etc.), secondary sources when they contain information about this literature (bibliographies, abstract journals, reviews, etc.), and tertiary sources when they are bibliographies of bibliographies or abstract journals.

If a project calls for maximum coverage of a particular topic, a bibliography of bibliographies is first consulted and the fullest information obtained on all the pertinent abstract journals and bibliographies. Then bibliography manuals, abstract journals, and bibliographies inside books and in appendixes are checked.

As far as an information service is concerned, the most important primary sources are the specialized journals, patents, and reports on new research projects, design studies, and trials. The journals publish articles and communications on the latest achievements, while patents describe original ideas. Books are less valuable because they normally contain information 2 to 3 years old. The time elapsing between the writing of a book and its publication is usually 5 to 10 times longer than the time needed to publish an article in a journal. An article generally discusses recent problems, often those still unsolved, and describes experiments and tests, whereas a book describes problems that have already been solved. Experts use articles to express the most varied and at times contradictory views. A book, on the other hand, sets forth the

view of a single author. A journal often contains more than articles: surveys of other sources of information; notes on books, patents, specifications, commercial literature; and bibliographies. It reports on international conferences, fairs, exhibits, research in Soviet and foreign institutes, new machine tools, and equipment.

Scientific organizations and researchers are greatly interested in the abstract journals of which there are now 360 titles. The number will obviously grow along with the increased output of literature. Publications now being abstracted are very numerous. An example is the American abstract journal on chemistry which includes items published in 5,500 periodicals in 31 languages.

Patent literature is an unusually valuable source for an information service. Patents contain the results of the creative efforts of many thousands of inventors and scientists throughout the world. Some 700 patents are issued daily in the most industrially advanced countries. An examination of this literature gives the information service a comprehensive view of the contemporary level of the particular field of technology. Many information services set up special groups to process patent literature.

A search of the literature should also cover such useful sources as graduation theses; dissertations; indexes of translations; reports on field trips; directories of libraries and technical information services, institutes, and publishing houses.

Illustrations are an important source of information. Their value lies in the fact that they can be understood by people speaking different languages. If one gives a specialist an article in a foreign language and it has no illustrations, chances are he will want to have it translated. However, if it is illustrated, even if he does not know the language, he will often be able to tell whether the article has anything of interest to him. That is why it is important to process illustrations along with books, articles, etc.

Technical information services in the USSR and abroad (especially in Czechoslovakia and the German Democratic Republic) most commonly organize illustrative material in the following ways: files of commercial literature consisting of prospectuses, catalogs, sketches, and photographs of foreign production; files of photographs of sketches found in books, articles, and other sources; files of negatives which substitute for a file of photographs if equipment to read the negatives is available; files of technical films. Many information services compile bibliographies of illustrations. A catalog card is made out for each photocopy.

The books of scientific and technical libraries vary with the nature of the sources of information required by the research institute or enterprise. Scientific libraries have a great many periodicals and technical reports. On such library in a USSR research institute has more than 70% of its materials in periodicals.

Our libraries do not pay enough attention to the acquisition of reports and technical documentation on completed research projects and experimental design and planning studies. They are lacking in most of the

libraries or constitute only an insignificant percentage of their holdings. In American libraries technical reports loom large, sometimes as much as 50 to 60%, while books make up a very small percentage (5%), although the resources as a whole are growing quickly. Many readers typically make use of scientific and technical reports. Patent literature, specifications, and commercial materials are well represented.

It is quite understandable why a number of countries are interested in abstracts and bibliographies. Although a good deal has been accomplished of late in organizing technical information and bibliographers, engineer-informants, and researchers is still a very time-consuming task. Not infrequently it is quicker to devise and build a new model than to try to find the needed information. This is demonstrated, for example, by the fact that almost one third of the requests for patents in the USA are rejected because they present nothing new. That is why scientific organizations in the United States and elsewhere try to have every project start with the compilation of a bibliography and selection of informational materials and end with an even more complete bibliographic listing. This of course solves in a very small way the problem of searching the literature, especially when we realize that the number of books, journals, patents, and other information in libraries almost doubles every 10 to 15 years. The existent methods of locating and selecting information are becoming ineffectual.

The Soviet Union, USA, Great Britain, France, and other countries are engaged in intensive work to mechanize the information processes, which even now help to reduce considerably the amount of time needed to search for, classify, and record information. Experimental machines used to translate technical texts and to proofread, search, collect, and record information have been designed and manufactured. A model electronic computer to prepare abstracts was exhibited in the USA in 1958. Information services have begun to use computers, dictophones, magnetophones, and self-recording machines capable of writing repetitive texts automatically at the rate of 1,000 strokes a minute. The Dutch have been using for years a variety of highly effective methods to reproduce information. The commonest are "Diazo" and xerography. "Diazo" is an improvement over the usual photostating. Xerography, a method based on the dry electrical process, is finding increasing favor. Light-weight portable reproduction devices weighing 2.5 to 3.5 kg are widely used. Continuous photography is another method. Cameras using 16-mm film can photograph about 5,000 manuscripts of any size in an hour.

Microphotography and microprinting are very important techniques. The former, for example, can reproduce the text of a book of 100 or more pages on a single ordinary-size page.

There is scarcely any doubt but that electronic machines selecting, classifying, and processing information so that 5 million units can be scanned in an hour will be available in the near future. Scientists and engineers are working hard to build machines, apparatus, and instruments that within 5 to 10 years will solve the problem of the automatization and mechanization of all the principal bibliographic information processes.

The training of personnel for industrial information services is extremely important. Scientific and technical information services arose in the USSR during the early five-year plans. Workers in these services grew with the development of the socialist industry. At first their general education and scientific-technical training were at a very low level. Now, however, most persons engaged in information activities have a suitable education or extensive work experience.

Engineer-informants and bibliographers must have broad interests, know the sources well, and have a command of foreign languages. The quality and method of processing the available information depend on the skill of the engineer-informants. Their success in choosing the required materials varies with their knowledge of library resources and reference tools.

Schools in the Soviet Union do not train specialists in scientific and technical information nor do they prepare their students to use reference literature and the bibliographic apparatus of libraries. When they go into industry after graduating from college, the young specialists know nothing of the resources of research and bibliographic centers. That is why for the first 2 or 3 years they do not work too efficiently; they must acquire knowledge through experience.

The scientific-technical community in the Soviet Union and abroad has called attention to the need for the extensive popularizing of bibliographic skills and for devising a special program to train information specialists. It would be desirable to organize special groups or departments in higher technical schools to train engineer-informants. It would also be worthwhile for our library schools to graduate librarians and bibliographers specifically for scientific and technical libraries. The curricula of these schools should be so arranged that at least 10 to 15% of the time is spent on specialized instruction in the field of the student's choice.

Many American colleges are giving courses on the principles of bibliography. The problem of training information personnel is being actively discussed in England and France. Last year the English created a college to train information specialists. Professional societies have come into existence. Some English experts suggest that all college students be required to take a course, with practical assignments, on the "Use of Sources of Information." A course in "How to Use Scientific and Technical Information" ought to be made compulsory in the Soviet Union.

Let us conclude.

Existent library, bibliographic, and information methods clearly do not come up to the present level of modern science and technology. They cannot ensure the completeness, high quality of choice, and timeliness of information. Conditions must be created to mechanize and automatize the information processes, thereby making it possible to accelerate 10-, 100-, and 1,000-fold the processes of searching, and handling the required materials.

Microfilming, microphotography, and microprinting should be more widely employed and greater attention paid to illustrative materials.

Information is the first and last step in every scientific project: the better and more widely organized the information, the quicker and easier it is to work out the scientific solution of a problem. Thus information should be regarded as one of the basic functions of a scientific institute or industrial enterprise.

It is therefore necessary to enlarge the information services and their bibliography groups, to staff them with qualified bibliographers and technicians, and to perfect the specialized training of engineer-informants and bibliographers. Information service personnel should know several foreign languages and continue to improve their linguistic skill.

The cost of setting up effective information services is slight (1 to 3% of all the expenditures for scientific and experimental work). The result will be to free about 30% of the time of the creative workers of the institutes and enterprises.

It is worthwhile, in our opinion, for higher educational institutions to introduce courses on the utilization of information, to reorganize the training of bibliographers and librarians and direct them into specialized fields, so that when the young specialists are graduated from library schools they will be familiar, if only along the main lines, with the particular branch of knowledge in which they are going to work.

A major problem is extensive popularization of bibliography and information procedures among researchers, innovators, inventors, and efficiency experts.

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Organization of an Information Service and Its Subdivisions

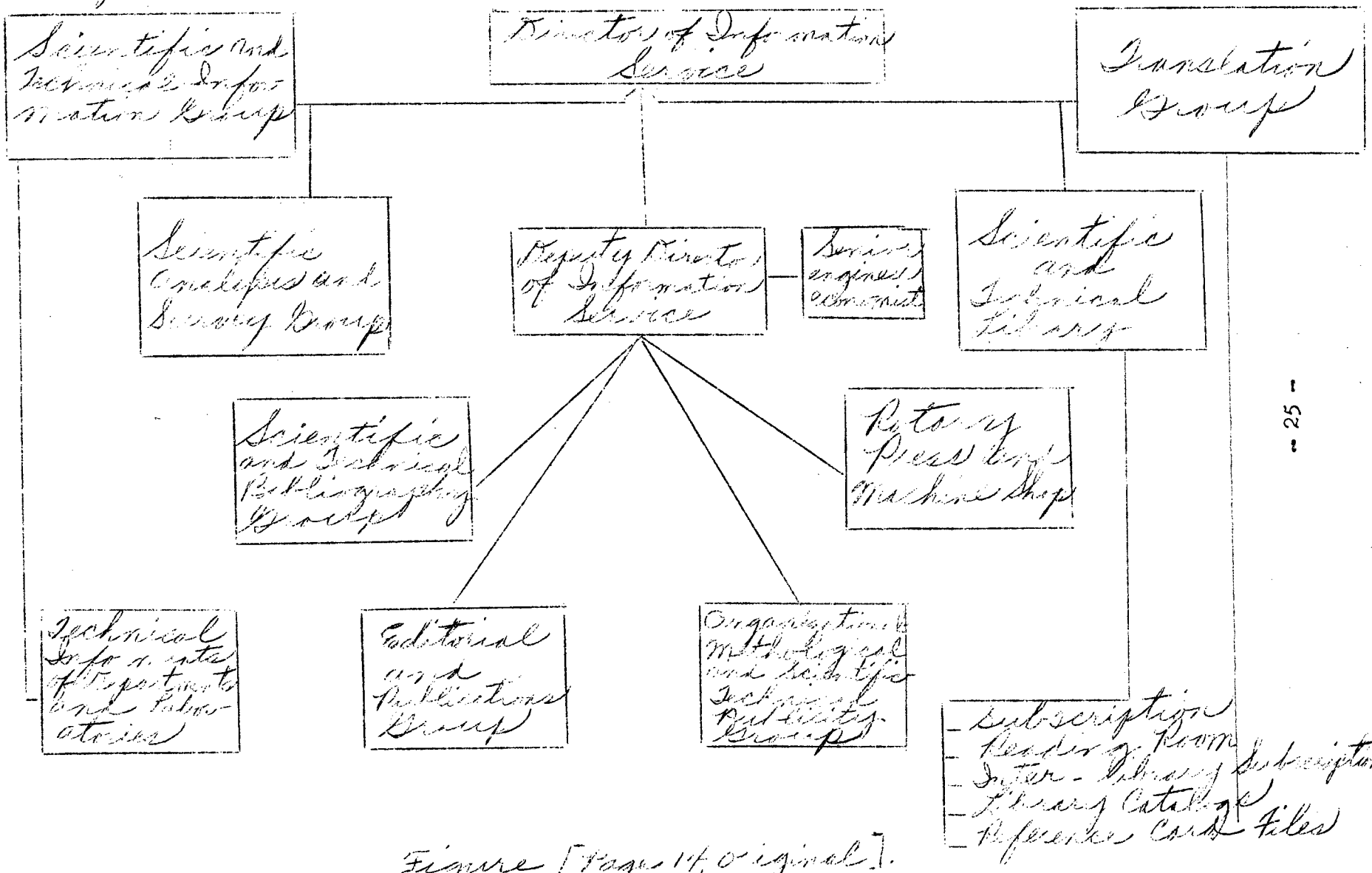

Figure [Page 14, original].

PROCESSING OF SOVIET AND FOREIGN INFORMATIONAL MATERIALS

BY THE INFORMATION SERVICE OF A RESEARCH INSTITUTE

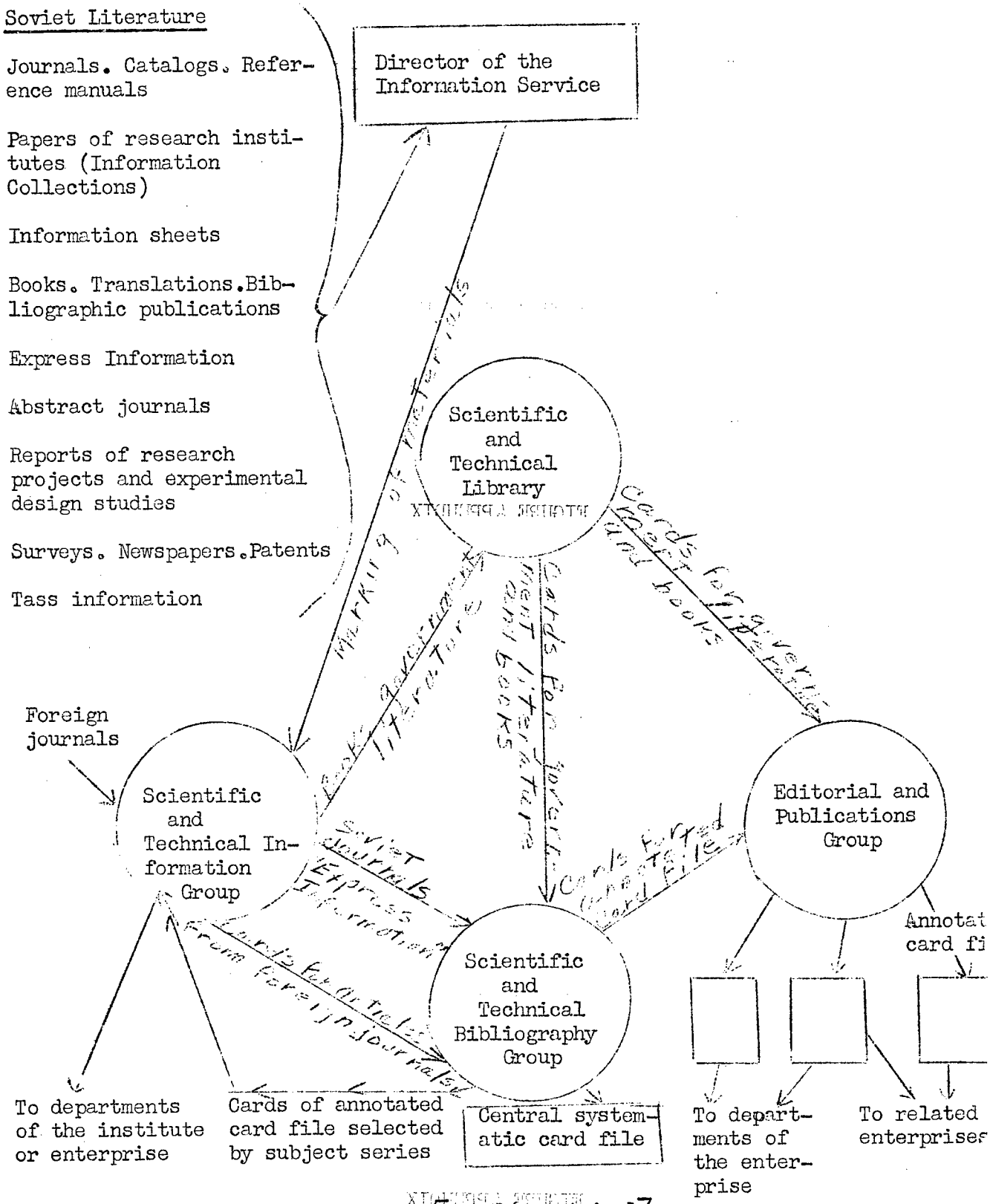

Figure /page 16, original/.